What is claimed is :

1. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein a threshold mode gain of each of said at least quantum well is not more than 12 $cm^{-1}$, and

wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is in the range of 75 meV to 200 meV.

2. The semiconductor device as claimed in claim 1, wherein a differential gain "dg/dn" of said at least active layer satisfies $0.5 \times 10^{-20}$ $(m^2) \leqq dg/dn \leqq 0.7 \times 10^{-20}$ $(m^2)$.

3. The semiconductor device as claimed in claim 1, wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i \leqq 12 \times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

4. The semiconductor device as claimed in claim 1, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S \geqq 3 \times \{\alpha_m/(12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)}) \times$$

$(\sqrt{}(R_1)+\sqrt{}(R_2))\}]$, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

5. The semiconductor device as claimed in claim 4, wherein said semiconductor device has a cavity length "L" of not less than 200 micrometers, and each of said first and second reflectances "$R_1$" and "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S \geqq 1.4/n$ (W/A).

6. The semiconductor device as claimed in claim 1, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

7. The semiconductor device as claimed in claim 1, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

8. The semiconductor device as claimed in claim 7, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

9. The semiconductor device as claimed in claim 7, wherein said

gallium-nitride-based multi-layer structure extends over a sapphire substrate.

10. The semiconductor device as claimed in claim 7, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8/cm^2$.

11. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein a threshold mode gain of each of said at least quantum well is not more than 12 $cm^{-1}$, and

wherein a differential gain "dg/dn" of said at least active layer satisfies $0.5 \times 10^{-20}$ ($m^2$) $\leqq$ dg/dn $\leqq 0.7 \times 10^{-20}$ ($m^2$).

12. The semiconductor device as claimed in claim 11, wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is in the range of 75 meV to 200 meV.

13. The semiconductor device as claimed in claim 11, wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i \leqq 12 \times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

14. The semiconductor device as claimed in claim 11, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S \geqq 3 \times \{\alpha_m/(12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)}) \times (\sqrt{(R_1)}+\sqrt{(R_2)})\}],$$

where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

15. The semiconductor device as claimed in claim 14, wherein said semiconductor device has a cavity length "L" of not less than 200 micrometers, and each of said first and second reflectances "$R_1$" and "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S \geqq 1.4/n$ (W/A).

16. The semiconductor device as claimed in claim 11, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

17. The semiconductor device as claimed in claim 11, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

18. The semiconductor device as claimed in claim 17, wherein said

gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

19. The semiconductor device as claimed in claim 17, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

20. The semiconductor device as claimed in claim 17, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

21. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein said semiconductor device has an internal loss "$\alpha_i$" (cm$^{-1}$) which satisfies $\alpha_i \leqq 12 \times n - \alpha_m$ (cm$^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is in the range of 75 meV to 200 meV.

22. The semiconductor device as claimed in claim 21, wherein a differential gain "dg/dn" of said at least active layer satisfies $0.5 \times 10^{-20}$

$(m^2) \leqq dg/dn \leqq 0.7 \times 10^{-20}\ (m^2)$.

23. The semiconductor device as claimed in claim 21, wherein a threshold mode gain of each of said at least quantum well is not more than $12\ cm^{-1}$.

24. The semiconductor device as claimed in claim 21, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S \geqq 3 \times \{\alpha_m/(12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)}) \times (\sqrt{(R_1)}+\sqrt{(R_2)})\}],$$

where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

25. The semiconductor device as claimed in claim 24, wherein said semiconductor device has a cavity length "L" of not less than 200 micrometers, and each of said first and second reflectances "$R_1$" and "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S \geqq 1.4/n$ (W/A).

26. The semiconductor device as claimed in claim 21, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

27. The semiconductor device as claimed in claim 21, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

28. The semiconductor device as claimed in claim 27, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

29. The semiconductor device as claimed in claim 27, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

30. The semiconductor device as claimed in claim 27, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

31. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ $(0<x<1, 0 \leqq y \leqq 0.2)$,

wherein said semiconductor device has an internal loss "$\alpha_i$" (cm$^{-1}$) which satisfies $\alpha_i \leqq 12 \times n - \alpha_m$ (cm$^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a differential gain "dg/dn" of said at least active layer

satisfies $0.5\times10^{-20}$ ($m^2$)$\leqq$dg/dn$\leqq0.7\times10^{-20}$ ($m^2$).

32. The semiconductor device as claimed in claim 31, wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is in the range of 75 meV to 200 meV.

33. The semiconductor device as claimed in claim 31, wherein a threshold mode gain of each of said at least quantum well is not more than 12 $cm^{-1}$.

34. The semiconductor device as claimed in claim 31, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$S \geqq 3\times\{\alpha_m/(12\times n)\}\times[\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)})\times(\sqrt{(R_1)}+\sqrt{(R_2)})\}]$, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

35. The semiconductor device as claimed in claim 34, wherein said semiconductor device has a cavity length "L" of not less than 200 micrometers, and each of said first and second reflectances "$R_1$" and "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S\geqq1.4/n$ (W/A).

36. The semiconductor device as claimed in claim 31, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

37. The semiconductor device as claimed in claim 31, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

38. The semiconductor device as claimed in claim 37, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

39. The semiconductor device as claimed in claim 37, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

40. The semiconductor device as claimed in claim 37, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

41. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S \geqq 3 \times \{\alpha_m /(12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)}) \times (\sqrt{(R_1)}+\sqrt{(R_2)})\}]$$

, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is in the range of 75 meV to 200 meV.

42. The semiconductor device as claimed in claim 41, wherein a differential gain "dg/dn" of said at least active layer satisfies $0.5 \times 10^{-20}$ ($m^2$)$\leqq$dg/dn$\leqq 0.7 \times 10^{-20}$ ($m^2$).

43. The semiconductor device as claimed in claim 41, wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i \leqq 12 \times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

44. The semiconductor device as claimed in claim 41, wherein a threshold mode gain of each of said at least quantum well is not more than 12 $cm^{-1}$.

45. The semiconductor device as claimed in claim 41, wherein said semiconductor device has a cavity length "L" of not less than 200 micrometers, and each of said first and second reflectances "$R_1$" and "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S \geqq 1.4/n$ (W/A).

46. The semiconductor device as claimed in claim 41, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

47. The semiconductor device as claimed in claim 41, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

48. The semiconductor device as claimed in claim 47, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

49. The semiconductor device as claimed in claim 47, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

50. The semiconductor device as claimed in claim 47, wherein said gallium-nitride-based multi-layer structure extends over a substrate having

a surface dislocation density of less than $1\times10^{8}$ /cm$^{2}$.

51. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0\leqq y\leqq 0.2$),

wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$S \geqq 3\times\{\alpha_m/(12\times n)\}\times[\{(1-R_1)\surd(R_2)\}/\{(1-\surd(R_1R_2))\times(\surd(R_1)+\surd(R_2))\}]$, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a differential gain "dg/dn" of said at least active layer satisfies $0.5\times10^{-20}$ (m$^2$)$\leqq$dg/dn$\leqq0.7\times10^{-20}$ (m$^2$).

52. The semiconductor device as claimed in claim 51, wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is in the range of 75 meV to 200 meV.

53. The semiconductor device as claimed in claim 51, wherein said semiconductor device has an internal loss "$\alpha_i$" (cm$^{-1}$) which satisfies $\alpha_i\leqq 12\times n-\alpha_m$ (cm$^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

54. The semiconductor device as claimed in claim 51, wherein a threshold mode gain of each of said at least quantum well is not more than 12 $cm^{-1}$.

55. The semiconductor device as claimed in claim 51, wherein said semiconductor device has a cavity length "L" of not less than 200 micrometers, and each of said first and second reflectances "$R_1$" and "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S \geqq 1.4/n$ (W/A).

56. The semiconductor device as claimed in claim 51, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

57. The semiconductor device as claimed in claim 51, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

58. The semiconductor device as claimed in claim 57, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

59. The semiconductor device as claimed in claim 57, wherein said

gallium-nitride-based multi-layer structure extends over a sapphire substrate.

60. The semiconductor device as claimed in claim 57, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1\times10^{8}$ /cm$^2$.

61. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0\leqq y\leqq0.2$),

wherein a threshold mode gain of each of said at least quantum well is more than 12 cm$^{-1}$, and

wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is not more than of 40 meV.

62. The semiconductor device as claimed in claim 61, wherein a differential gain "dg/dn" of said at least active layer satisfies $dg/dn \geqq 1.0\times10^{-20}$ (m$^2$).

63. The semiconductor device as claimed in claim 61, wherein said semiconductor device has an internal loss "$\alpha_i$" (cm$^{-1}$) which satisfies $\alpha_i > 12\times n - \alpha_m$ (cm$^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of

said at least quantum well.

64. The semiconductor device as claimed in claim 61, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S < 3 \times \{\alpha_m / (12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\} / \{(1-\sqrt{(R_1 R_2)}) \times (\sqrt{(R_1)} + \sqrt{(R_2)})\}]$$

, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

65. The semiconductor device as claimed in claim 64, wherein said semiconductor device has a cavity length "L" of not less than 1000 micrometers, and said first reflectance "$R_1$" is not more than 20%, said second reflectance "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S < 2.1/n$ (W/A).

66. The semiconductor device as claimed in claim 61, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

67. The semiconductor device as claimed in claim 61, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

68. The semiconductor device as claimed in claim 67, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

69. The semiconductor device as claimed in claim 67, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

70. The semiconductor device as claimed in claim 67, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

71. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein a threshold mode gain of each of said at least quantum well is more than 12 cm$^{-1}$, and

wherein a differential gain "dg/dn" of said at least active layer satisfies $dg/dn \geqq 1.0 \times 10^{-20}$ (m$^2$).

72. The semiconductor device as claimed in claim 71, wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is not more than of 40 meV.

73. The semiconductor device as claimed in claim 71, wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i > 12 \times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

74. The semiconductor device as claimed in claim 71, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$S < 3 \times \{\alpha_m/(12 \times n)\} \times [\{(1-R_1)\sqrt{}(R_2)\}/\{(1-\sqrt{}(R_1 R_2)) \times (\sqrt{}(R_1)+\sqrt{}(R_2))\}]$, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

75. The semiconductor device as claimed in claim 74, wherein said semiconductor device has a cavity length "L" of not less than 1000 micrometers, and said first reflectance "$R_1$" is not more than 20%, said second reflectance "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S < 2.1/n$ (W/A).

76. The semiconductor device as claimed in claim 71, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

77. The semiconductor device as claimed in claim 71, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

78. The semiconductor device as claimed in claim 77, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

79. The semiconductor device as claimed in claim 77, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

80. The semiconductor device as claimed in claim 77, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

81. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein said semiconductor device has an internal loss "$\alpha_i$" (cm$^{-1}$) which satisfies $\alpha_i > 12 \times n \times \alpha_m$ (cm$^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a standard deviation of a microscopic fluctuation in a

band gap energy of said at least luminescent layer is not more than of 40 meV.

82. The semiconductor device as claimed in claim 81, wherein a differential gain "dg/dn" of said at least active layer satisfies $dg/dn \geqq 1.0 \times 10^{-20}$ (m2).

83. The semiconductor device as claimed in claim 81, wherein a threshold mode gain of each of said at least quantum well is more than 12 $cm^{-1}$.

84. The semiconductor device as claimed in claim 81, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S < 3 \times \{\alpha_m/(12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)}) \times (\sqrt{(R_1)}+\sqrt{(R_2)})\}],$$

where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

85. The semiconductor device as claimed in claim 84, wherein said semiconductor device has a cavity length "L" of not less than 1000 micrometers, and said first reflectance "$R_1$" is not more than 20%, said second reflectance "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S < 2.1/n$ (W/A).

86. The semiconductor device as claimed in claim 81, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

87. The semiconductor device as claimed in claim 81, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

88. The semiconductor device as claimed in claim 87, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

89. The semiconductor device as claimed in claim 87, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

90. The semiconductor device as claimed in claim 87, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

91. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of

$In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0\leqq y\leqq 0.2$),

wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i > 12\times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a differential gain "dg/dn" of said at least active layer satisfies $dg/dn \geqq 1.0\times 10^{-20}$ ($m^2$).

92. The semiconductor device as claimed in claim 91, wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is not more than of 40 meV.

93. The semiconductor device as claimed in claim 91, wherein a threshold mode gain of each of said at least quantum well is more than 12 $cm^{-1}$.

94. The semiconductor device as claimed in claim 91, wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S < 3\times\{\alpha_m/(12\times n)\}\times[\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)})\times(\sqrt{(R_1)}+\sqrt{(R_2)})\}],$$

where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

95. The semiconductor device as claimed in claim 94, wherein said

semiconductor device has a cavity length "L" of not less than 1000 micrometers, and said first reflectance "$R_1$" is not more than 20%, said second reflectance "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S < 2.1/n$ (W/A).

96. The semiconductor device as claimed in claim 91, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

97. The semiconductor device as claimed in claim 91, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

98. The semiconductor device as claimed in claim 97, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

99. The semiconductor device as claimed in claim 97, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

100. The semiconductor device as claimed in claim 97, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

101. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0\leqq y\leqq 0.2$),

wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$S < 3\times\{\alpha_m/(12\times n)\}\times[\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)})\times(\sqrt{(R_1)}+\sqrt{(R_2)})\}]$, where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is not more than of 40 meV.

102. The semiconductor device as claimed in claim 101, wherein a differential gain "dg/dn" of said at least active layer satisfies $dg/dn \geqq 1.0\times 10^{-20}$ ($m^2$).

103. The semiconductor device as claimed in claim 101, wherein a threshold mode gain of each of said at least quantum well is more than 12 $cm^{-1}$.

104. The semiconductor device as claimed in claim 101, wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i > 12 \times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

105. The semiconductor device as claimed in claim 101, wherein said semiconductor device has a cavity length "L" of not less than 1000 micrometers, and said first reflectance "$R_1$" is not more than 20%, said second reflectance "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S < 2.1/n$ (W/A).

106. The semiconductor device as claimed in claim 101, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

107. The semiconductor device as claimed in claim 101, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

108. The semiconductor device as claimed in claim 107, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

109. The semiconductor device as claimed in claim 107, wherein said

gallium-nitride-based multi-layer structure extends over a sapphire substrate.

110. The semiconductor device as claimed in claim 107, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.

111. A semiconductor device having a semiconductor multi-layer structure which includes at least an active layer having at least a quantum well, and said active layer further including at least a luminescent layer of $In_xAl_yGa_{1-x-y}N$ ($0<x<1$, $0 \leqq y \leqq 0.2$),

wherein said semiconductor device has a slope efficiency "S" (W/A) which satisfies :

$$S < 3 \times \{\alpha_m/(12 \times n)\} \times [\{(1-R_1)\sqrt{(R_2)}\}/\{(1-\sqrt{(R_1R_2)}) \times (\sqrt{(R_1)}+\sqrt{(R_2)})\}],$$

where "$R_1$" is a first reflectance of a first cavity facet, from which a light is emitted, "$R_2$" is a second reflectance of a second cavity facet opposite to said first cavity facet, "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well, and

wherein a standard deviation of a microscopic fluctuation in a band gap energy of said at least luminescent layer is not more than of 40 meV.

112. The semiconductor device as claimed in claim 111, wherein a differential gain "dg/dn" of said at least active layer satisfics $dg/dn \geqq 1.0 \times$

$10^{-20}$ ($m^2$).

113. The semiconductor device as claimed in claim 111, wherein a threshold mode gain of each of said at least quantum well is more than 12 $cm^{-1}$.

114. The semiconductor device as claimed in claim 111, wherein said semiconductor device has an internal loss "$\alpha_i$" ($cm^{-1}$) which satisfies $\alpha_i > 12 \times n - \alpha_m$ ($cm^{-1}$), where "$\alpha_m$" is a mirror loss, and "n" is a number of said at least quantum well.

115. The semiconductor device as claimed in claim 111, wherein said semiconductor device has a cavity length "L" of not less than 1000 micrometers, and said first reflectance "$R_1$" is not more than 20%, said second reflectance "$R_2$" is not less than 80% and less than 100%, and said slope efficiency "S" satisfies $S < 2.1/n$ (W/A).

116. The semiconductor device as claimed in claim 111, wherein said semiconductor device has a photo-luminescence peak wavelength distribution of not more than 40 meV.

117. The semiconductor device as claimed in claim 111, wherein said semiconductor multi-layer structure comprises a gallium-nitride-based multi-layer structure.

118. The semiconductor device as claimed in claim 117, wherein said gallium-nitride-based multi-layer structure extends over a gallium-nitride-based substrate.

119. The semiconductor device as claimed in claim 117, wherein said gallium-nitride-based multi-layer structure extends over a sapphire substrate.

120. The semiconductor device as claimed in claim 117, wherein said gallium-nitride-based multi-layer structure extends over a substrate having a surface dislocation density of less than $1 \times 10^8$ /cm$^2$.